

What is claimed is:

1 1. A light-emitting device with reduced lattice
2 mismatch, comprising:

3 a substrate having a first lattice constant;

4 a first buffer multilayer deposited on said
5 substrate, wherein the lattice constant of said
6 first buffer multilayer ranges from said first
7 lattice constant at the bottom of said first
8 buffer multilayer to a second lattice constant
9 at the top of said first buffer multilayer;

10 a second buffer multilayer deposited on said first
11 buffer multilayer, wherein the lattice constant
12 of said second buffer multilayer ranges from
13 said second lattice constant at the bottom of
14 said second buffer multilayer to a third
15 lattice constant at the top of said second
16 buffer multilayer; and

17 a GaN base epitaxial layer deposited on the surface
18 of said second buffer multilayer with said
19 third lattice.

1 2. The device as claimed in claim 1, wherein said
2 substrate comprises silicon, said first buffer multilayer
3 is represented by general formula $B_xGa_{(1-x)}P$ (where $0.02 \leq X$
4 ≤ 1), and said second buffer multilayer is represented by
5 general formula $In_yGa_{(1-y)}N$ (where $0 \leq y \leq 0.059$).

1 3. The method as claimed in claim 1, wherein said
2 substrate comprises 3C-SiC, said first buffer multilayer
3 is represented by general formula $B_xGa_{(1-x)}P$ (where $X=1$),

4 and said second buffer multilayer is represented by
5 general formula $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ (where $0 \leq y \leq 0.059$).

1 4. The method as claimed in claim 1, wherein said
2 substrate comprises GaP, said first buffer multilayer is
3 represented by general formula $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ (where $0 \leq X \leq 1$),
4 and said second buffer multilayer is represented by
5 general formula $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ (where $0 \leq y \leq 0.059$).

1 5. The method as claimed in claim 1, wherein said
2 substrate comprises GaAs, said first buffer multilayer
3 comprises $\text{GaAs}_x\text{P}_{(1-x)}$ and $\text{B}_y\text{Ga}_{(1-y)}\text{P}$ (where $0 \leq X \leq 1$, $0 \leq y \leq 1$), and said second buffer multilayer is represented by
4 general formula $\text{In}_z\text{Ga}_{(1-z)}\text{N}$ (where $0 \leq z \leq 0.059$).

1 6. A light-emitting device with reduced lattice
2 mismatch, comprising:

3 a silicon substrate having a first lattice constant;
4 a $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ buffer layer deposited on said silicon
5 substrate, wherein the lattice constant of said
6 $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ buffer layer ranges from said first
7 lattice constant at the bottom of said $\text{B}_x\text{Ga}_{(1-x)}\text{P}$
8 buffer layer to a second lattice constant at
9 the top of said $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ buffer layer;

10 a $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer layer deposited on said $\text{B}_x\text{Ga}_{(1-x)}\text{P}$
11 buffer layer, wherein the lattice constant of
12 the $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer layer ranges from said
13 second lattice constant at the bottom of said
14 $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer layer to a third lattice
15 constant at the top of said $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer
16 layer; and

17 a GaN-based epitaxial layer deposited on the $\text{In}_y\text{Ga}_{(1-y)}\text{N}$
18 buffer layer with said third lattice
19 constant.

1 7. A light-emitting device with reduced lattice
2 mismatch, comprising:

3 a 3C-SiC substrate having a first lattice constant;
4 a $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ buffer layer deposited on said 3C-SiC
5 substrate, wherein the lattice constant of said
6 $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ buffer layer ranges from said first
7 lattice constant at the bottom of said $\text{B}_x\text{Ga}_{(1-x)}\text{P}$
8 buffer layer to a second lattice constant at
9 the top of said $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ buffer layer;

10 a $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer layer deposited on said $\text{B}_x\text{Ga}_{(1-x)}\text{P}$
11 buffer layer, wherein the lattice constant of
12 said $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer layer ranges from said
13 second lattice constant at the bottom of said
14 $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer layer to a third lattice
15 constant at the top of said $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer
16 layer; and

17 a GaN-based epitaxial layer deposited on the $\text{In}_y\text{Ga}_{(1-y)}\text{N}$
18 buffer layer with third lattice constant.

1 8. A light-emitting device with reduced lattice
2 mismatch, comprising:

3 a GaAs substrate having a first lattice constant;
4 a $\text{GaAs}_x\text{P}_{(1-x)}$ buffer layer deposited on said GaAs
5 substrate, wherein the lattice constant of said
6 $\text{GaAs}_x\text{P}_{(1-x)}$ buffer layer ranges from said first
7 lattice constant at the bottom of said $\text{GaAs}_x\text{P}_{(1-x)}$

x) buffer layer to a second lattice constant at the top of said $\text{GaAs}_x\text{P}_{(1-x)}$ buffer layer;
a $\text{B}_y\text{Ga}_{(1-y)}\text{P}$ buffer layer deposited on said $\text{GaAs}_x\text{P}_{(1-x)}$ buffer layer, wherein the lattice constant of said $\text{B}_y\text{Ga}_{(1-y)}\text{P}$ buffer layer ranges from said second lattice constant at the bottom of said $\text{B}_y\text{Ga}_{(1-y)}\text{P}$ buffer layer to a third lattice constant at the top of said $\text{B}_y\text{Ga}_{(1-y)}\text{P}$ buffer layer;
a $\text{In}_z\text{Ga}_{(1-z)}\text{N}$ buffer layer deposited on said $\text{B}_y\text{Ga}_{(1-y)}\text{P}$ buffer layer, wherein the lattice constant of said $\text{In}_z\text{Ga}_{(1-z)}\text{N}$ buffer layer ranges from said third lattice constant at the bottom of said $\text{In}_z\text{Ga}_{(1-z)}\text{N}$ buffer layer to a fourth lattice constant at the top of said $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer layer; and
a GaN-based epitaxial layer deposited on said $\text{In}_z\text{Ga}_{(1-z)}\text{N}$ buffer layer with said fourth lattice constant.

9. A light-emitting device with reduced lattice mismatch, comprising:

a GaP substrate having a first lattice constant;
a $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ buffer layer deposited on said GaP substrate, wherein the lattice constant of said $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ buffer layer ranges from said first lattice constant at the bottom of said $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ buffer layer to a second lattice constant at the top of said $\text{B}_x\text{Ga}_{(1-x)}\text{P}$ buffer layer;

10 a $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer layer deposited on said $\text{B}_x\text{Ga}_{(1-x)}\text{P}$
11 buffer layer, wherein the lattice constant of
12 said $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer layer ranges from said
13 second lattice constant at the bottom of said
14 $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer layer to a third lattice
15 constant at the top of said $\text{In}_y\text{Ga}_{(1-y)}\text{N}$ buffer
16 layer; and
17 a GaN-based epitaxial layer deposited on said $\text{In}_y\text{Ga}_{(1-}$
18 $y)\text{N}$ buffer layer with said third lattice
19 constant.